

WHAT IS CLAIMED IS:

1. An optical transmission apparatus for transmitting an optical pulse string having a frequency two times that of a driving signal, said optical transmission apparatus comprising:
 - a Mach-Zehnder optical modulator;
 - a light source which inputs an optical signal into said optical modulator;
 - a driving unit which inputs the driving signal into the optical modulator;
 - a converting unit which takes out a part of an optical signal output from said optical modulator and converts that part of the optical signal into electric signal;
 - an extracting unit which extracts a frequency component of the driving signal included in the electric signal converted by said converting unit;
 - an error signal generating unit which generates an error signal of a bias voltage for minimizing a value of a frequency component of the driving signal extracted by said extracting unit; and
 - a bias voltage control unit which applies a bias voltage obtained as a result of addition of the bias voltage and a voltage corresponding to the error signal to said optical modulator.

2. The optical transmission apparatus according to claim
1, wherein

5 said light source generates a modulated optical pulse
synchronous with the driving signal and having a bit rate
two times that of the driving signal, and supplies the optical
pulse to said optical modulator, and

10 said optical modulator pulse modulates the optical
pulse with the driving signal and outputs the modulated
optical pulse.

15 3. The optical transmission apparatus according to claim
1, wherein said light source includes a plurality of
single-wavelength light sources each of which emits light
having different single-wavelength,

20 15 said optical transmission apparatus further
comprising an optical filter, provided at the front stage
of said converting unit, which transmits light having only
a desired wavelength out of the lights having different
wavelength emitted by said single-wavelength light sources
that constitute an optical signal output from said optical
modulator.

25 4. The optical transmission apparatus according to claim
1 further comprising a dither signal generating unit which
generates a dither signal that is input into the error signal

generating unit and the bias voltage control unit, wherein
said error signal generating unit carries out a
synchronous detection by multiplying a dither signal to a
frequency component of a driving signal or a frequency
5 component two times that of the driving signal extracted
by said extracting unit, and outputs a result of this
synchronous detection to the bias voltage control unit as
an error signal of the bias voltage, and

10 said bias voltage control unit applies to said optical
modulator a signal obtained by superimposing the error signal
of the bias voltage with the bias voltage and the dither
signal.

5. An optical transmission apparatus for transmitting
15 an optical pulse string having a frequency two times that
of a driving signal, said optical transmission apparatus
comprising:

a Mach-Zehnder optical modulator;
a light source which inputs an optical signal into
20 said optical modulator;

a driving unit which inputs the driving signal into
said optical modulator;

a converting unit which takes out a part of an optical
signal output from said optical modulator and converts that
25 part of the optical signal into electric signal;

an extracting unit which extracts a frequency component two times that of the driving signal included in the electric signal converted by said converting unit;

an error signal generating unit which generates an error signal of a bias voltage for maximizing a value of the frequency component two times that of the driving signal extracted by said extracting unit; and

5 a bias voltage control unit which applies a bias voltage added with an error signal of the bias voltage to said optical 10 modulator.

6. The optical transmission apparatus according to claim 5, wherein

15 said light source generates a modulated optical pulse synchronous with the driving signal and having a bit rate two times that of the driving signal, and supplies the optical pulse to said optical modulator, and

20 said optical modulator pulse modulates the optical pulse with the driving signal and outputs the modulated optical pulse.

7. The optical transmission apparatus according to claim 5, wherein said light source includes a plurality of single-wavelength light sources each of which emits light 25 having different single-wavelength,

5 said optical transmission apparatus further comprising an optical filter, provided at the front stage of said converting unit, which transmits light having only a desired wavelength out of the lights having different wavelength emitted by said single-wavelength light sources that constitute an optical signal output from said optical modulator.

8. The optical transmission apparatus according to claim 10 5 further comprising a dither signal generating unit which generates a dither signal that is input into the error signal generating unit and the bias voltage control unit, wherein

15 said error signal generating unit carries out a synchronous detection by multiplying a dither signal to a frequency component of a driving signal or a frequency component two times that of the driving signal extracted by said extracting unit, and outputs a result of this synchronous detection to the bias voltage control unit as an error signal of the bias voltage, and

20 said bias voltage control unit applies to said optical modulator a signal obtained by superimposing the error signal of the bias voltage with the bias voltage and the dither signal.

9. A bias voltage control method for an optical modulator to be used for an optical transmission apparatus that inputs an optical signal into a Mach-Zehnder optical modulator, applies a driving signal and a bias voltage to said optical modulator, and transmits an optical pulse string having a frequency two times that of the driving signal, the method comprising the steps of:

5 taking out a part of an optical signal output from said optical modulator and converting that part of the 10 optical signal into electric signal;

extracting a frequency component of the driving signal from the obtained electric signal;

generating an error signal of a bias voltage for minimizing a value of the frequency component of the driving 15 signal; and

applying a bias voltage obtained as a result of addition of the bias voltage and a voltage corresponding to the error signal to said optical modulator.

20 10. A bias voltage control method for an optical modulator to be used for an optical transmission apparatus that inputs an optical signal into a Mach-Zehnder optical modulator, applies a driving signal and a bias voltage to said optical modulator, and transmits an optical pulse string having a 25 frequency two times that of the driving signal, the method

comprising the steps of:

 taking out a part of an optical signal output from said optical modulator and converting that part of the optical signal into electric signal;

5 extracting a frequency component two times that of the driving signal from the obtained electric signal;

 generating an error signal of a bias voltage for maximizing a value of the frequency component two times that of the driving signal; and

10 applying a bias voltage obtained as a result of addition of the bias voltage and a voltage corresponding to the error signal to said optical modulator.